DEPARTMENT OF THE ARMY
U.S. ARMY CENTER FOR HEALTH PROMOTION AND PREVENTIVE MEDICINE
5158 BLACKHAWK ROAD
ABERDEEN PROVING GROUNDS, MARYLAND 21010-5403

REPLY TO
ATTENTION OF:

MCHB-TS-EWS

24 March 2003

EXECUTIVE SUMMARY
WATER QUALITY INFORMATION PAPER NO. 31-034
USE OF BOTTLED WATER FOR DEPLOYMENT SUPPORT

1. PURPOSE. This information paper has been prepared for use by Major Command (MACOM) staff planners, their commanders, and the general Preventive Medicine (PVNTMED) community. It discusses the appropriate use of bottled drinking water for forces deployed in contingency or combat operations, operations in support of natural/man-made disasters, Stability and Support Operations (SASO), and Homeland Security/Defense. The paper addresses the following topics: (1) Department of Defense (DOD) and Federal bottled water regulations and standards; (2) health protection, logistical, and cost considerations; and (3) identifying approved sources for bottled water procurement.

2. CONCLUSIONS. The use of bottled water in deployments has increased dramatically during the last decade due to its rapid availability, its logistical flexibility, and its immediate acceptability by the deployed force. The procurement and distribution of bottled water is a viable option for providing safe drinking water to deployed forces. However, the monetary costs and sustained logistical burden of procuring, transporting, and distributing bottled water in the field, along with managing the empty-bottle wastes make bottled drinking water far more costly than drinking water produced from the ROWPU and other approved sources. The associated risks of procuring, distributing, and storing bottled water must be identified and managed to better protect the health of the soldier and ensure unit readiness. The risk of waterborne illnesses to soldiers drinking either bottled water or ROWPU produced water should be minimal to nonexistent if the source selection, treatment, distribution, and monitoring procedures all comply with the applicable Federal, DOD, or Army regulations and guidance.

3. RECOMMENDATIONS. Include bottled water as one (and probably the most expensive) of several viable options available to leaders and planners to provide adequate quantities of safe, palatable drinking water to deployed forces. Use the Bottled Water Use Decision Logic (Appendix E) to balance drinking water requirements against the maturity and force structure of the theater to determine the quantity of drinking water required, the appropriate duration of bottled water usage, and the optimum use of ROWPU produced water or other developed water sources. Use the Risk Assessment Matrix for Bottled Water Use (Appendix F) to minimize potential health concerns associated with bottled water consumption during deployments. Ensure PVNTMED assets are consulted when selecting or approving a source of bottled water and are fully integrated into the plan to distribute, store, and monitor bottled water supplies during all phases of a deployment.

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2. REFERENCES. A list of references is provided in Appendix A.

3. DEFINITIONS. Definitions of terms related to bottled water and its production and quality are provided in Appendix B.

4. BACKGROUND.

a. Military Bottled Water Usage. Bottled water use as a means of providing potable water to deployed troops worldwide has increased appreciably during the last decade. Some reasons for the increase include: the flexibility that bottled water offers planners, the perception that bottled water provides a better quality of life standard than other field drinking water options (e.g., no taste or odor concerns), and the reduction in required force structure in a theater (i.e., the ability to reduce or eliminate water production and distribution unit requirements). Military planners have found that bottled water can be readily used as a supplement to or be a complete replacement for some of the tactical potable water collection, treatment, and distribution systems. Bottled water can provide flexibility in developing a theater-wide water support plan that is protective of soldier health. The increased reliance on bottled water use in the field has precipitated the need to provide practical guidance for MACOM-level staff planners and their commanders on bottled water use during deployments.

b. Bottled Water Regulations and Industry Standards. Bottled water is classified as a food product by the United States. Standards, regulations, and guidelines applicable to its production, packaging, and distribution include U.S. Food and Drug Administration (FDA) standards and criteria, Army Regulations (AR), and International Bottled Water Association (IWBA) guidelines.

(1) Food and Drug Administration. FDA regulations for bottled water produced or packaged in the U.S. are promulgated in the Code of Federal Regulations (CFR), Title 21, Parts 129 (reference 1) and 165.110(b) (reference 2). Part 129 provides criteria to determine whether or not bottled water production facilities, methods, practices, and controls conform to good manufacturing practices. Part 165.110 defines bottled water and provides the nomenclature and labeling requirements for bottled water from different sources. It also identifies mandatory physical, chemical, microbiological, and radiological standards for bottled water and describes acceptable analytical methods to be used to determine compliance with those standards. The standards, reproduced here in Appendix C, are in many cases identical to the U.S. Environmental Protection Agency's (EPA) maximum contaminant levels (MCLs) for community drinking water systems presented in 40 CFR Part 141. Source waters are required to be analyzed annually for chemical and physical parameters, and every four years for radiological parameters. If they are not municipal waters, they must be analyzed for microbiological quality weekly. For finished product, representative bacteriological sampling is required weekly, and chemical, physical, and radiological samples are to be analyzed annually for each type of product produced.

(2) DOD Regulations.

(a) AR 40-657/NAVSUPINST 4355.4F/MCO P1011031G, Veterinary/Medical Food Inspection and Laboratory Service (reference 4), defines the food inspection mission of the U.S Army Veterinary Service and sets forth the policies and procedures for inspection of food and food establishments. This regulation establishes requirements for the Commander, U.S. Army Veterinary Command (VETCOM) and Commanders of overseas MACOMs (Unified Commands) to publish "A Directory of Sanitarily Approved Food Establishments for Armed Forces Procurement (short title: Directory)," for their areas of responsibility inside and outside the continental United States (CONUS), respectively. It designates bottled water as a member of Food Supply Classification (FSC) 8960, - Food Item: Beverage, nonalcoholic, making it applicable to the inspection of bottled water production facilities, their certification as approved providers, and their addition to the appropriate Directory after they have been approved. It also charges Army preventive medicine (PVNTMED) personnel with the responsibility for conducting sanitary inspections of bottled water establishments in overseas areas for Directory listing (para 2-1.d, AR 40-675).

(b) Military Standard (MIL STD) 3006A, Sanitation Requirements for Food Establishments (reference 5), establishes sanitation requirements for establishments which produce, process, or store various types of food products before or after final acceptance by an element of DOD. Appendix K of MIL STD 3006A specifically addresses bottled water/soft drink processing facilities. Standards and inspection criteria in MIL-STD 3006 incorporate the following documents by reference: 21 CFR, Parts 129 and 165; and 40 CFR Part 141, National Primary Drinking Water Regulations. The standards are presented as a checklist, each one essentially reiterating and referencing one or more paragraphs in the FDA standards cited above. The standards are applicable to bottled water produced in CONUS and outside the Continental United States (OCONUS) for DOD procurement.

(c) Army Office of the Surgeon General (OTSG). In 1996, the OTSG published guidance for the microbiological testing of bottled water after it is received from a production facility. This guidance applies to all bottled water used during deployments, and must be implemented as the bottled water is received in a central storage facility, warehouse, port of entry, or other theater area issue point. PM personnel are required to perform microbiological testing on representative water samples from each delivery lot every 30 days until the entire lot is consumed. Specific guidance and testing requirements are provided in Appendix D.

(3) International Bottled Water Association. The IBWA is the trade association that represents the bottled water industry. The IBWA's member companies produce and distribute 80 percent of the bottled water sold in the U.S. Membership in the IBWA includes U.S. and international bottlers, distributors, and suppliers. The IBWA model code is designed to be used to develop legislation in states and municipalities, and has already been used as such in at least fifteen states. This model code itself is not enforceable on a bottler unless it is adopted by the state or local governing body where the bottler is located. The inspection and testing criteria, as well as contaminant limits in the code, are similar to those of the FDA and DOD.

5. CONSIDERATIONS FOR USING BOTTLED WATER.

a. Health Protection Considerations. From PVNTMED and health protection standpoints, bottled water from an approved provider gives personnel the same level of microbiological quality as any other drinking water that is approved and provided by the military. As long as the bottling source has been inspected and approved by the appropriate Army Veterinary and/or PM personnel, and the prescribed post-production quality monitoring is conducted, that bottled water can be considered safe. In many cases, bottled water is treated similarly to water produced and distributed by fixed facility municipal drinking water plants or by field equipment, such as the Reverse Osmosis Water Purification Unit (ROWPU). While most bottled water is disinfected with chlorine or ozone, it is not normally bottled with a disinfectant residual to prevent bacterial regrowth. If transportation, handling, and/or storage procedures are poor, bottled water could pose a greater risk of illness for consumers than other forms of potable water supply that may be available to them.

b. Logistics Considerations. In recent years, bottled water has been typically used at some stage in various operations. Usually, bottled water has been used during the initial phase of deployments, when bulk water systems have not been fully developed. Planners should carefully consider the need and duration for bottled water use. As a rule, 2 days of supply (DOS) should be sufficient in most cases to allow doctrinal field water systems to be established. However, more than 2 DOS may be required because of mission requirement, environment, transportation, and storage availability. Maintaining more than 5 DOS burdens transportation and distribution systems, requires a great deal of testing by PVNTMED units, is expensive, and can create unwanted unit location signatures. If the use of bottled water is required, planners should select the appropriate daily consumption factor from the U.S. Army Combined Arms Support Command (CASCOM) Water Planning Guide (reference 6) to determine what the bulk water requirements will be. For example, in a temperate environment, the water requirement factor is 1.5 gallons per person per day. This factor applies to those soldiers who are not supported by bulk water systems.

c. Cost Considerations. The decision to use bottled water may have significant cost implications. For instance, in support of troops in Uzbekistan in 2002, the Defense Logistics Agency (DLA) estimated the total cost for purchasing and transporting nearly 1 million liters (260,000 gallons) of bottled water was $871,000. Bottled water usage during deployment in Afghanistan in 2002 was also costly. According to DLA, each shipment of bottled water to Afghanistan (30 containers, 42,129 gallons) cost the Army $82,240 ($2,741 per container). These shipments were routed from Bahrain to Kandahar at transportation costs of $3,835 per container. The total cost to get the water to Kandahar, then, was $6,576 per container, or $4.64 per gallon. During a 3-month period, seven shipments totaling 294,840 gallons were sent to Kandahar at a total cost of approximately $1,381,030. In comparison, if a ROWPU unit had been used to provide the same quantity of water, the cost would have been substantially lower as shown in Table 1 below. The time frame for the ROWPU estimate was not provided; however, it should be noted that the longer the ROWPU support is sustained, the greater the cost savings.

Table 1. Afghanistan Potable Water Cost Comparison

Type of Water Supply	Total Cost	Cost per Gallon
Bottled Water	$1,381,030	$4.69
ROWPU[1]	$315,000	$1.07

1. This is an estimated cost for transportation of an Army Quartermaster water purification unit and its equipment into theater along with consumable supplies. These numbers are based on a total volume consumed of 294,840 gallons.

d. Other Considerations. Some additional issues that bear consideration include solid waste disposal, intentional or unintentional chemical contamination, and force protection.

(1) Disposal of plastic bottles, bulk packing, and packaging material is a solid waste issue that must be considered. Unlike the ROWPU, bottled water generates an additional burden on solid waste management and disposal systems during a deployment. This burden is much lighter when ROWPU assets are used to produce drinking water.

(2) Bottled water is not guaranteed to be free of contaminants. Past bottled water chemical contamination incidents, such as the unintentional benzene contamination of Perrier water in the 1980s, illustrate this point. Bottling facilities and supply chains that are not controlled by the military provide an avenue for intentional or unintentional contamination. Although certification of bottled water manufacturers includes verification of annual organic and inorganic chemical contamination analyses, chemical water quality cannot be guaranteed at the point of consumption, especially in OCONUS areas. PVNTMED units do not have the expertise or equipment to routinely conduct extensive monitoring of chemical quality in the field.

(3) Regularly scheduled delivery of bottled water to base camps or other troop locations by local commercial transportation companies presents the potential threat of planned or opportunistic terrorist activity. This threat opportunity is appreciably reduced when ROWPUs or other water production assets under the control and supervision of the U.S. military are used.

e. Bottled Water Decision Logic. Appendix E describes a logical risk management procedure that can help evaluate some of the pros and cons of choosing to use bottled water in a deployment situation. The steps involved are similar to the guidance in reference 7, and have been written to include other potential sources in addition to bottled water. When ROWPU production capacity, theater population, or other aspects of the water support plan change substantially, this decision logic should be used to evaluate if a better option for providing potable water support exists. For example, in an immature theater, sufficient water purification assets may not be immediately available to meet the entire demand, and other sources must be identified to temporarily supplement what ROWPU production there is. As additional water production assets arrive in theater and become established, ROWPU production may be able to meet the entire demand, and the need for alternate water sources will be reduced or eliminated.

6. IDENTIFYING APPROVED SOURCES FOR BOTTLED WATER PROCUREMENT. Updated versions of the Directory of Approved Food Sources for each MACOM (CONUS and South America, Europe, U.S. Central Command, and Korea) can be found on the VETCOM Internet website: http://vets.amedd.army.mil/vetcom/index.html. Directories can be searched by food item, vendor name, or vendor location. Other website sub pages provide information on providers recently added or deleted from each directory. Bottled water is classified by several different names, including, but not limited to, "bottled water," "bottled potable water," and "bottled drinking water." If a potential source of bottled water supplies is not listed in the directory, an audit/inspection can be requested and performed using the information on the website. If that is not possible, another option would be to contact the local U.S. Army Veterinary or PVNTMED personnel.

a. Managing the Risk of Bottled Water Use. The Risk Management approach described in Field Manual (FM) 100-14, Risk Management (reference 7), can be applied to examine the factors involved in bottled water use. Using this methodology, medical planners, operational personnel, and commanders can assess and manage the risks by establishing controls and judging their effectiveness. A gastro-intestinal (GI) tract illness caused by microbiological contamination is the primary hazard associated with bottled water use. Determining the probability and severity of a microbiological contamination event on an individual or unit basis is somewhat subjective, but is primarily affected by three factors. These factors include the quality of the bottled water, the PVNTMED assets available to conduct testing and monitor health trends, and supply and storage conditions. Each of these factors is discussed below. Appendix F lists the combinations of the three factors and their associated risk categories. Hazards from low concentrations of chemical contaminants normally pose only a chronic (i.e., long-term) health threat, if any, and will not impact negatively on mission accomplishment or force sustainment during the deployment.

b. Source Quality.

(1) Probability of Contamination. Source quality refers to the quality of sanitation and the past history of the manufacturer providing the bottled water. First and foremost, bottlers that are not in the directory and thus are not DOD-approved should never be used as a source. When assessing the probability that bottled water from a DOD-approved bottling source is contaminated, the following three classifications should be used: (1) seldom or unlikely, (2)

likely or occasional, and (3) frequent. For DOD-approved bottling sources with known good records of quality, including no record of past microbial contamination events, and good plant construction and operations that are conducive to sanitation, select seldom or unlikely. For bottling plants that are approved by the DOD, but that have had some microbial contamination incidents in the past, choose the "likely" or "occasional" probability. This distinction should be determined based on the number and frequency of past contamination events. Approved bottling plants with no details on past microbial contamination incidents should be classified as "occasional." Bottlers with a probability rating of "frequent" should never be used.

(2) Severity of the Event. The degree of susceptibility to GI tract illness from microbial contamination varies among individual soldiers, but is affected by factors such as general health and fitness, the amount of rest received on a regular basis, and seasonal conditions. The effects of a microbial contamination can range from marginal to catastrophic. When evaluating risks to individual soldiers, contamination and a resulting illness would often result in lost workdays (i.e., a marginal severity). When evaluating the risk to an entire unit, multiple soldiers in the same unit experiencing lost workdays simultaneously due to contaminated water could severely impact a unit's ability to accomplish its mission. In such cases the severity of the incident on mission accomplishment could be considered critical.

c. PVNTMED Water Quality Monitoring Assets.

(1) Probability of Contamination. If adequate PVNTMED assets are not available to conduct microbiological sampling of bottled water, they should carefully monitor routine health trends to identify a possible contamination event. This monitoring would be effective in identifying contamination because the probability of an illness is negligible to marginal; therefore, any illness caused by bottled water could likely be traced back to it. Another consideration would be the level of experience the PVNTMED staff has in water monitoring. If limited PVNTMED personnel are available, but have other duties and surveillance activities that are a higher priority, the probability of an illness affecting a unit's ability to accomplish a mission is increased.

(2) Severity of the Event. The PVNTMED monitoring assets have an indirect effect on the severity of a contamination event. The severity of an illness from GI tract infection due to microbially contaminated drinking water is marginal (i.e., minor mission degradation or lost workdays) when assessed for the individual soldier. However, PVNTMED personnel can greatly influence how a large quantity of bottled water affects the health of a unit. If the medical support structure is monitoring health trends, such as sick call attendance and diagnoses, potential contamination events can be detected early enough to prevent additional soldiers or an entire unit from becoming sick.

d. Supply Chain and Storage Conditions.

(1) Probability of Contamination. The longer the supply chain (in days) and the warmer the climate, the greater would be the probability of finding contaminated bottled water. Higher temperatures promote growth of bacteria, and the increased time allows for the bacterial growth cycle to occur. Since any remaining disinfectant (e.g., chlorine or ozone) is normally removed

from treated water prior to putting it into bottles, bacteriological growth can go unnoticed and unchecked. Water which was safe at the bottling plant can become unsafe due to bacterial growth in as little as several weeks, or in very poor conditions within several days of packaging. Storage time and conditions at the consuming unit as well as at the central receiving/distribution location, must be evaluated to determine the probability of a contamination event.

(2) Severity of the Event. Conditions in the supply chain and during storage have an indirect effect on the severity of a contamination event. The severity must be judged collectively with the other factors in mind. The severity of a contamination incident could increase as the time in the supply chain increases and/or as conditions in the chain become poor. The severity increase is due to the probability that a greater number of individual bottles could develop growth that would in-turn mean that more soldiers could contract the illness if not detected by PVNTMED testing.

7. CONCLUSIONS. The use of bottled water in deployments has increased dramatically during the last decade due to its rapid availability, its logistical flexibility, and its immediate acceptability by the deployed force. The procurement and distribution of bottled water is a viable option for providing safe drinking water to deployed forces. However, the monetary costs and sustained logistical burden of procuring, transporting, and distributing bottled water in the field, along with managing the empty-bottle wastes make bottled drinking water far more costly than drinking water produced from the ROWPU and other approved sources. The associated risks of procuring, distributing, and storing bottled water must be identified and managed to better protect the health of the soldier and ensure unit readiness. The risk of waterborne illnesses to soldiers drinking either bottled water or ROWPU produced water should be minimal to nonexistent if the source selection, treatment, distribution, and monitoring procedures all comply with the applicable Federal, DOD, or Army regulations and guidance.

8. RECOMMENDATIONS. Include bottled water as one (and probably the most expensive) of several viable options available to leaders and planners to provide adequate quantities of safe, palatable drinking water to deployed forces. Use the Bottled Water Use Decision Logic (Appendix E) to balance drinking water requirements against the maturity and force structure of the theater to determine the quantity of drinking water required, the appropriate duration of bottled water usage, and the optimum use of ROWPU produced water or other developed water sources. Use the Risk Assessment Matrix for Bottled Water Use (Appendix F) to minimize potential health concerns associated with bottled water consumption during deployments. Ensure PVNTMED assets are consulted when selecting or approving a source of bottled water and are fully integrated into the plan to distribute, store, and monitor bottled water supplies during all phases of a deployment.

9. ADDITIONAL SUPPORT. Additional support on topics associated with bottled water use in deployment operations can be obtained from the U.S. Army Center for Health Promotion and Preventive Medicine (USACHPPM), Water Supply Management Program (WSMP), DSN 584-3919, commercial (410) 436-3919.

Prepared in part under contract for USACHPPM, WSMP by Radian, Inc.

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APPENDIX A

REFERENCES

1. 21 CFR 129, Processing and Bottling of Bottled Drinking Water, 1 April 2002 revision.

2. 21 CFR 165.110(b), Requirements for Specific Standardized Beverages - Bottled water, 1 April 2002 revision.

3. 40 CFR 141, National Primary Drinking Water Regulations, current revision.

4. AR 40-657/NAVSUPINST 4355.4F/MCO P1011031G, Veterinary/Medical Food Inspection and Laboratory Service, Headquarters, Department of the Army (HQDA), OTSG, 6 November 1997.

5. MIL STD 3006A, Sanitation Requirements for Food Establishments, HQDA, OTSG, 20 August 2000, available at the Defense Technical Information Center website (http://163.12.140.8/eAccess/index.cfm?ident_number=208822).

6. CASCOM Potable Water Planning Guide, CASCOM Directorate of Combat Developments for Quartermaster, 15 June 1999, available at www.cascom.lee.army.mil/quartermaster/combat.htm.

7. FM 100-14, Risk Management, U.S. Army Training and Doctrine Command, 23 April 1998.

8. Technical Bulletin Medical (TB MED) 577, Sanitary Control and Surveillance of Field Water Supplies, March 1986.

9. FM 4-25.12, Unit Field Sanitation Team, 25 January 2002.

APPENDIX B

DEFINITIIONS

Artesian Water/Artesian Well Water – water from a well that taps a confined aquifer in which the natural water level stands at some height above the top confining layer of the aquifer.

Bacteriological/Microbiological Testing – for the purposes of compliance, performing tests on samples of water that determine the presence or absence of coliform organisms as an indication that the water is free from contamination by pathogenic organisms.

Bottled Water – water that is intended for human consumption and that is sealed in bottles or other containers with no added ingredients except that it may optionally contain safe and suitable levels of antimicrobial agents and fluoride.

Ground Water – water from a sub-surface saturated zone that is under a pressure equal to or greater than atmospheric pressure.

Mineral Water – water from boreholes or springs that naturally contains not less than 250 mg/L total dissolved solids (TDS). No minerals may be added. The term "low mineral content" means the water contains less than 500 mg/L TDS and "high mineral content" means it contains more than 1500 mg/L TDS.

Packaged Water – water which is produced and packaged by the U.S. Military for use by military and civilian personnel in a field environment.

Palatable Water – Water that is pleasing to the senses, primarily taste and smell.

Potable Water - water that has been examined and treated to meet appropriate standards and declared fit for domestic consumption by an appropriate medical authority.

Purified Water – water that has been produced by distillation, deionization, reverse osmosis, or other suitable processes to meet the definition of "purified water" in the U.S. Pharmacopeia, current revision. It may be referred to as "_____ water," or "_____ drinking water," with the blanks being filled in with the term "purified" or with the name of the process used to produce it (e.g., "reverse osmosis drinking water," or "deionized water").

Sparkling Bottled Water – water that, after treatment and possible replacement of carbon dioxide, contains the same amount of carbon dioxide that it had at emergence from the source.

Spring Water – water derived from an underground formation from which water flows naturally to the surface of the earth.

Sterile/Sterilized Water – water that meets the requirements under the "Sterility Tests" in the current revision of the U.S. Pharmacopeia. It is free from living organisms.

Well Water – water from a hole bored, drilled, or otherwise constructed in the ground which taps the water of an aquifer.

APPENDIX C

MCLs FOR BOTTLED WATER

(Extracted from 21 CFR 165.110, 1 April 2001 Edition)

Table C-1. Allowable Levels for Chemical Substances.

Contaminant	Maximum Concentration (mg/L)
Arsenic	0.05
Chloride [a]	250.0
Iron [a]	0.3
Manganese [a]	0.05
Phenols	0.001
Total dissolved solids [a]	500.0
Zinc [a]	5.0
Total Trihalomethanes	0.10

[a] Mineral water is exempt from allowable level. The exemptions are aesthetically based allowable levels and do not relate to a health concern.

Table C-2. Allowable Levels for Inorganic Contaminants

Contaminant	Maximum Concentration (mg/L)
Antimony	0.006
Barium	2
Beryllium	0.004
Cadmium	0.005
Chromium	0.1
Copper	1.0
Cyanide	0.2
Lead	0.005
Mercury	0.00
Nickel	0.1
Nitrate	10 (as N)
Nitrite	1 (as N)
Total Nitrate and Nitrite	10 (as N)
Selenium	0.05
Thallium	0.002

Table C-3. Allowable Levels for Volatile Organic Chemicals

Contaminant (CAS Reg. No.)	Maximum Concentration (mg/L)
Benzene (71-43-2)	0.005
Carbon tetrachloride (56-23-5)	0.005
o-Dichlorobenzene (95-50-1)	0.6
p-Dichlorobenzene (106-46-7)	0.075
1,2-Dichloroethane (107-06-2)	0.005
1,1-Dichloroethylene (75-35-4)	0.007
cis-1,2-Dichloroethylene (156-59-2)	0.07
trans-1,2-Dichloroethylene (156-60-5)	0.1
Dichloromethane (75-09-2)	0.005
1,2-Dichloropropane (78-87-5)	0.005
Ethylbenzene (100-41-4)	0.7
Monochlorobenzene (108-90-7)	0.1
Styrene (100-42-5)	0.1
Tetrachloroethylene (127-18-4)	0.005
Toluene (108-88-3)	1
1,2,4-Trichlorobenzene (120-82-1)	0.07
1,1,1-Trichloroethane (71-55-6)	0.20
1,1,2-Trichloroethane (79-00-5)	0.005
Trichloroethylene (79-01-6)	0.005
Vinyl chloride (75-01-4)	0.002
Xylenes (1330-20-7)	10.0

Table C-4. Allowable Levels for Pesticides and Other Synthetic Organic Chemicals

Contaminant (CAS Reg. No.)	Maximum Concentration (mg/L)
Alachlor (15972-60-8)	0.002
Atrazine (1912-24-9)	0.003
Benzo(a)pyrene (50-32-8	0.0002
Carbofuran (1563-66-2)	0.04
Chlordane (57-74-9)	0.002
Dalapon (75-99-0)	0.2
1,2-Dibromo-3-chloropropane (96-12-8)	0.0002
2,4-D (94-75-7)	0.07
Di(2-ethylhexyl)adipate (103-23-1)	0.4
Dinoseb (88-85-7)	0.007
Diquat (85-00-7)	0.02
Endothall (145-73-3)	0.1
Endrin (72-20-8)	0.002
Ethylene dibromide (106-93-4)	0.00005
Glyphosate (1071-53-6)	0.7
Heptachlor (76-44-8)	0.0004
Heptachlor epoxide (1024-57-3)	0.0002
Hexachlorobenzene (118-74-4)	0.001
Hexachlorocyclopentadiene (77-47-4)	0.05
Lindane (58-89-9)	0.0002
Methoxychlor (72-43-5)	0.04
Oxamyl (23135-22-0)	0.2
Pentachlorophenol (87-86-5)	0.001
PCB's (as decachlorobiphenyl) (1336-36-3)	0.0005
Picloram (1918-02-1)	0.5
Simazine (122-34-9)	0.004
2,3,7,8-TCDD (Dioxin) (1746-01-6)	3×10^{-8}
Toxaphene (8001-35-2)	0.003
2,4,5-TP (Silvex) (93-72-1)	0.05

Table C-5. Allowable Levels for Certain Chemicals for which EPA has Established Secondary MCLs in its Drinking Water Regulations (40 CFR Part 143)

Contaminant	Maximum Concentration (mg/L)
Aluminum	0.2
Silver	0.1
Sulfate [a]	250.0

[a.] Mineral water is exempt from allowable level.
The maximum concentrations are aesthetically based on allowable levels and do not relate to a health concern.

APPENDIX D

MICROBIOLGICAL TESTING OF BOTTLED AND PACKAGED WATER

(adapted from the 1996 DA Message)

1. Bottled water is water that is sealed in bottles, packages, or other containers by a commercial (non-military) source for human consumption, including bottled mineral water. Packaged water is water that has been produced and packaged by the military for military use in the field environment.

2. There are recognized occasions where packaged water or bottled water should be used until tactical water purification/storage/distribution assets become available to the commander and are established. When water treatment units are established and available, commanders should maximize their tactical water equipment usage to sustain the force.

3. Water produced and packaged by the military will conform to the updated Tri-Service Field Water Quality Standards. PVNTMED personnel will periodically inspect military purification and packaging operations to ensure compliance with accepted practices in TB MED 577, Sanitary Control and Surveillance of Field Water Supplies. Specifically, water will contain at least one part per million chlorine at time of packaging. Packaged water is considered potable for immediate consumption as long as a measurable chlorine residual exists. Packaged water will be tested for the presence of coliform bacteria the same way as bottled water, as specified in paragraph 5 below. If microbial testing cannot be done, the presence of measurable chlorine residual in packaged water will be adequate to issue packages as potable water to units.

4. Bottled water in support of DOD personnel and operations will be obtained from Veterinary Service or PVNTMED personnel-approved sources. A list of approved sources can be found in the Directory of Sanitarily Approved Food Establishments for Armed Forces Procurement for the respective Command. The U.S. Army Veterinary Service or PVNTMED personnel will inspect bottling facilities to ensure compliance with acceptable sanitation standards which impact on the final product. Samples of the finished product will be randomly obtained at the time of each inspection and sent to the appropriate laboratory for microbiological and chemical analyses. The details and frequency of CONUS and OCONUS Bottling Facility Inspections will be in accordance with (IAW) MIL STD 3006A, Sanitation Requirements for Food Establishments.

5. PVNTMED personnel are responsible for microbial testing of bottled and packaged water after delivery/receipt. These efforts will ensure potability prior to issue. Bottled water and packaged water should be tested periodically IAW the following guidance:

a. Total coliform testing will be performed using the membrane filter technique, or by a defined substrate method, such as Colilert® or Colisure®. Each lot shall be tested for total

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coliforms upon receipt at a central storage facility, warehouse, port of entry, or other theater area issue point. One percent of the total number of bottles for each lot shall be tested up to a maximum of ten samples. Samples shall be collected randomly throughout the lot.

b. Each lot will be sampled every 30 days at major storage sites and end user locations until the lot is exhausted. This allows the shelf life of bottled and packaged water to be extended in 30-day increments, provided testing is done as required. One percent of each lot up to a maximum of ten samples will be tested. Water may continue to be issued during the 24-hour period that coliform analysis is being conducted. If the water is found to be unsafe for consumption, all recipients of the subject lot will be notified and provided disposition instructions accordingly.

c. If any sample is coliform positive, use and/or issue of that lot should be suspended pending immediate resampling to confirm coliform presence. One percent of the remainder of the lot, up to ten samples, should be collected and analyzed. If the confirmation resampling is positive for coliforms, the lot should not be used for potable purposes. Units to which the lot has been issued should be notified and provided disposition instructions accordingly.

6. If no other source of potable water is available, bottled or packaged water that has tested positive for coliforms may be issued for consumption with the stipulation that an additional disinfectant such as iodine, chlorfloc, chlorine bleach, etc., must be used to treat the contaminated water, or it should be boiled, prior to consumption, IAW FM 4-25.17, Unit Field Sanitation Team, 25 January 2002.

7. Bottled and/or packaged water should not be stored in direct sunlight. It should be stored in shaded, well-ventilated areas, and in boxes that keep the packages upright. Bottled/packaged water should be managed on a "first in – first out" basis. Bottled water stored in direct sunlight for more than 5 days should be tested for coliform contamination using the guidance in paragraph 5. Properly stored and tested packaged water may continue to be issued as long as PVNTMED personnel approve safety of water.

APPENDIX E

BOTTLED WATER USE DECISION LOGIC

1. **Are functional ROWPUs available in theater?**

   a. Yes. Can available assets meet demand?

      (1) Yes. Use available ROWPU assets. Go to Step 6.
      (2) No. Go to Step 2.

   b. No. Go to Step 2.

2. **Determine the difference between production capability and demand.**

   a. Identify which users/demands are best suited to ROWPU, and which are best suited to other sources of supply. Base the evaluation on:

      (1) Distance to lines of supply.
      (2) Demand/number of troops at each location.
      (3) Intended use (drinking, maintenance, medical, etc.). (See Table E-1, Water Quality Standards for Nonconsumptive uses.)
      (4) Suitability of prospective source to use based on logistics (e.g., bottled water not feasible for showering). Consider shelf life/testing of bottled water and available PVNTMED assets in decisions.

   b. Determine the amount of water to be provided by ROWPU and the amount of water to be provided by sources other than ROWPU.

   c. Go to Step 3.

3. **Identify sources to meet remaining demand. Are other sources available?**

   a. Yes.

      (1) Bring additional ROWPU units into theater? (Consider unit availability and/or "tooth to tail" ratio, theater force caps.) Go to Step 6.
      (2) Identify other bulk water sources available with acceptable quality (e.g., host nation or contractor fixed facility treatment, other non-potable sources, seawater). (See Table 1, Water Quality Standards for Nonconsumptive uses.) Go to Step 6.

   b. No. Go to Step 4.

4. **Are Bottled water sources available in the region or Theater?**

a. Yes. Verify that source is DOD-approved by consulting the Directory or local Veterinary or PVNTMED units.

(1) If approved, use the identified source. Conduct periodic microbiological testing per Appendix D. Go to Step 6.
(2) If not approved, determine if source was once listed, but removed from list due to sanitary conditions. If warranted, request and conduct sanitary inspection IAW AR 40-657 and MIL-STD 3006. If facility meets criteria, use it as a source. Conduct periodic microbiological testing per Appendix C. Go to Step 6.

b. No. Go to Step 5.

5. **Consider other alternatives.**

a. Purchase bottled water in another region/theater and ship it into theater (use the same steps as in para 4a for proposed vendor in other region/theater). The tradeoff of aircraft sorties or other delivery means used to deliver bottled water vs. delivery of other mission-critical personnel, equipment, or supplies into the theater should be considered. Go to Step 6.

b. Consider imposing water use restrictions and conservation methods such as limiting the number of showers per soldier per week, reduced maintenance/washing schedules, consolidation of multiple similar activities (e.g., consolidated mess halls), etc. (see Table D-1, Water Quality Standards for Nonconsumptive Uses). Estimate water savings from restrictions, re-evaluate options, and start over (go to Step 2).

6. **Re-evaluate periodically.** Re-evaluate the water support concept using this process as ROWPU production capacity, theater population, or other aspects of the situation, theater, or water support plan change. For example, in an immature theater, sufficient water purification assets may not be immediately available to meet the entire demand, and other sources must be identified to temporarily supplement ROWPU production. As purification assets arrive in theater, become established, and provide water, ROWPU production may be able to meet the entire demand and the need for alternate water sources will decrease.

Table
E-1. Water Quality Standards for Nonconsumptive Uses

(Extracted from TB MED 577, Sanitary Control and Surveillance of Field Water Supplies, March 1986)

Water Quality	Uses Include
Potable water	a. Mess operations, such as food washing b. Personal hygiene, such as shaving, brushing teeth, helmet baths, and comfort cooling c. Medical treatment d. Photoprocessing for quality control e. Ice production for food preservation and cooling f. Water hose and pipeline testing and flushing
Disinfected nonpotable fresh water	a. Centralized hygiene, such as field showers b. Decontamination of personnel c. Retrograde cargo washing d. Heat casualty body cooling e. Graves registration personnel sanitation f. Well development
Nonpotable fresh water	a. Vehicle coolant b. Aircraft washing c. Pest control d. Field laundry e. Concrete construction f. Well drilling
Seawater	a. Vehicle washing* b. Electrical grounding c. Fire fighting d. Nuclear, biological, and chemical (NBC) decontamination of material

*Seawater may lead to significant corrosion of some mechanical parts. Consider nonpotable fresh water if available.

APPENDIX F

RISK ASSESSMENT MATRIX FOR BOTTLED WATER USE

EVALUATION OF THE RISK LEVEL OF PERSONNEL ILLNESSES RESULTING FROM INGESTION OF MICROBIOLOGICALLY CONTAMINATED BOTTLED DRINKING WATER

How to use this Appendix:

1. Make a determination of each of the three factors involved in the risk, source, PVNTMED support, and supply and storage conditions.

a. Source.

(1) Approved. A source approved for DOD procurement and listed in the Directory of Sanitarily Approved Food Establishments for Armed Forces Procurement for the respective Command.

(2) Unapproved. A source not listed or removed from the Directory of Sanitarily Approved Food Establishments for Armed Forces Procurement for the respective Command. Note that unapproved sources should never be used until certified by Veterinary personnel following the guidance in MIL-STD 3006A.

b. PVNTMED Support.

(1) Adequate. There are sufficient PVNTMED assets in theater to accomplish the routine testing of bottled water described in Appendix D at multiple locations in the theater while also accomplishing other PVNTMED surveillance activities.

(2) Marginal. Doctrinally adequate numbers of PVNTMED assets are available in theater, but other duties and surveillance activities reduce their ability to accomplish the testing in Appendix D.

(3) Low. There are not enough PVNTMED personnel in theater to accomplish the testing described in Appendix D and other higher priority PVNTMED surveillance activities further aggravate the problem.

c. Supply and Storage Conditions.

(1) Adequate. Shipping and storage facilities protect individual bottles from the weather, particularly the sun and temperatures exceeding 90° F, and shipping/storage time from the manufacturer to the individual service member is normally less than 3 weeks and the manufacturer-stamped expiration dates on the bottles have not been exceeded.

(2) Marginal. Shipping and storage facilities protect individual bottles from the weather, particularly the sun and temperatures exceeding 90° F, but shipping/storage time from the manufacturer to the individual service member is normally longer than 3 weeks. Expiration dates are close.

(3) Low. Shipping and storage facilities do not protect individual bottles from the weather, particularly the sun and temperatures exceeding 90° F, and shipping/storage time from the manufacturer to the individual service member is normally longer than 3 weeks. Expiration dates have been exceeded.

2. Based on the assessment of each factor, identify what scenario is applicable using Table F-1. Note that the numbers in each box of Figure F-1 correspond to the scenario in Table F-1.

3. Using either Table F-1 or Figure F-1, determine the level of risk from soldier illnesses or reduced mission performance as a result of ingesting microbiologically contaminated bottled drinking water.

Table F-1. Evaluation of the Risk of Soldier Illnesses from Ingesting Microbiologically Contaminated Bottled Drinking Water

SCENARIO	SOURCE	PVNTMED SUPPORT	SUPPLY & STORAGE CONDITIONS	RISK	RISK CLASS
1	APPROVED	ADEQUATE	ADEQUATE	LOW	IV/E
2	APPROVED	ADEQUATE	MARGINAL	LOW	IV/D
3	APPROVED	ADEQUATE	POOR	LOW	IV/C
4	APPROVED	MARGINAL	ADEQUATE	LOW	III/E
5	APPROVED	MARGINAL	MARGINAL	LOW	III/D
6	APPROVED	MARGINAL	POOR	MODERATE	III/C
7	APPROVED	LOW	ADEQUATE	LOW	II/E
8	APPROVED	LOW	MARGINAL	MODERATE	II/D
9	APPROVED	LOW	POOR	HIGH	II/C
10	UNAPPROVED	ADEQUATE	ADEQUATE	LOW	III/E
11	UNAPPROVED	ADEQUATE	MARGINAL	LOW	III/D
12	UNAPPROVED	ADEQUATE	POOR	MODERATE	III/C
13	UNAPPROVED	MARGINAL	ADEQUATE	LOW	II/E
14	UNAPPROVED	MARGINAL	MARGINAL	MODERATE	II/D
15	UNAPPROVED	MARGINAL	POOR	HIGH	II/C
16	UNAPPROVED	LOW	ADEQUATE	MODERATE	II/D
17	UNAPPROVED	LOW	MARGINAL	MODERATE	II/D
18	UNAPPROVED	LOW	POOR	HIGH	II/C

Figure F-1. Risk Levels Associated with the Factors Involved in a Bottled Water Microbiological Contamination Event